

Revision of the Genus *Cochlidium* (Grammitidaceae)

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The genus *Cochlidium* was first proposed by Kaulfuss in 1820. However, the name was ignored for more than a century after its publication. Most of the species now recognized as members of the genus were included in the later *Pleurogramme* (Blume) Presl or, following Hooker (1864), were sunk into the broad concept of *Monogramma*. A detailed exposition of the generic concepts of the major nineteenth century workers would serve more to illustrate the confusion over the relationship of these ferns than to illuminate their taxonomic history. Some idea of this uncertainty can be gained by noting the number of genera to which certain of the species have been assigned.

Christensen (1929) revived Kaulfuss' name, and with characteristic care and insight provided the basis for the modern concept of the genus. He included here all the New World grammitid ferns with coenosori and one species, *C. furcatum*, with discrete, polypodioid sori. A. C. Smith (1930) later transferred another such species, *C. connellii*, to the genus. Copeland (1947), however, removed such species to the genus *Grammitis*, basing his concept of *Cochlidium* strictly on the coenosoral character.

Morton (1967) rightly deplored the artifice of Copeland's larger genera in the Grammitidaceae. His remedy was to dissolve his predecessor's genera into a single, very large genus *Grammitis*, recognizing the former groupings as equally artificial sections. From my understanding of the family, I believe that consistency with such a practice would necessitate the inclusion of all species of the family into a single genus, for none of Copeland's generic circumscriptions are without intimately related species that he included elsewhere. If a natural classification is the desired goal, the failure of another worker to define and differentiate his taxa properly is scarcely reason for their indiscriminate dissolution.

The genus *Cochlidium*, as here construed, consists of those neotropical grammitid ferns with simple and entire or at most sinuate fertile laminae, concolorous scales, hydathodes, and 2-8-celled hairs which characteristically have thickened intercellular walls and are frequently somewhat catenate. The presence of hydathodes will separate these species from nearly all those New World species of Grammitidaceae with simple fronds, and concolorous scales will remove them from many of the smaller species formerly included in *Xiphopteris*. The typical hairs are absent from the two highly derived and completely glabrous species, *C. rostratum* and *C. linearifolium*. In other species, these hairs seem to be a good indication of the relationship of some superficially quite distinct plants.

Another unifying and distinguishing feature of the genus is the stelar organization of the rhizome. Most other Grammitidaceae exhibit a fundamentally solenostelic pattern. A cross-section of the *Cochlidium* rhizome shows 1-3 vascular

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bundles, each with a straight or lightly arced row of tracheids. This contrasts sharply with the basically circular arrangement seen in most other grammitid ferns.

The presence of a coenosorus is a conspicuous feature in the genus. In most species in which it occurs, however, the coenosorus is occasionally or even frequently interrupted. On the other hand, in *C. jungens* the sori are in some plants entirely separate, although normally there is much soral fusion in most populations, occasionally to the point of forming a complete coenosorus. This shows that the coenosorus, considered an all-important generic character by Copeland and earlier authors, is not necessarily stable on even the species level. All stages leading to the compound sorus from free veins and separate sori are indicated by these variations. Also, the free receptacles of *C. serrulatum* are basal on the veins, parallel to and frequently almost fused with the costa, and are terminated by the abruptly geniculate sterile portion of the vein. This arrangement strongly suggests this species' derivation from a coenosoral ancestor.

Another character notable in the group with compound sori is the tendency of the fertile lamina to fold conduplicately over the sporangia. This feature is characteristic of certain species (*C. pumilum* and, interestingly, *C. serrulatum*), but occurs in at least some individuals of most species. My own observations in Costa Rica suggest that in *C. rostratum* folded fronds occur in plants inhabiting more stressful environments. The fronds of those species with polypodioid sori borne distally on the fertile veins seem never to exhibit conduplicate folding.

I wish to thank the staff of the U.S. National Herbarium for making this facility fully available to me, and to express my appreciation to John T. Mickel and Bruce McAlpin for their aid in my work at New York Botanical Garden. All specimens not otherwise indicated are at US.

Cochlidium Kaulf. Berlin. Jahrb. Pharm. Verbunden. Wiss. 1820: 36. 1820.

Xiphopteris Kaulf. Berlin. Jahrb. Pharm. Verbunden. Wiss. 1820: 35. 1820. LECTOTYPE: *Acrostichum serrulatum* Swartz [= *Xiphopteris serrulata* (Swartz) Kaulf.], chosen by J. Smith, Hist. Fil. 179. 1875.

Micropteris Desv. Mém. Soc. Linn. Paris 6: 217. 1827. LECTOTYPE: *Acrostichum serrulatum* Swartz [= *Micropteris serrulata* (Swartz) Desv.], chosen by Copeland, Gen. Fil. 215. 1947.

Antrophyum sect. *Pleurogramme* Blume, Fl. Jav. Fil. 69. 1829. LECTOTYPE: *Taenitis linearis* Kaulf. [= *Pleurogramme linearis* (Kaulf.) Presl], chosen by J. Smith, Hist. Fil. 177. 1875.

Pleurogramme (Blume) Presl., Tent. Pterid. 223. 1836.

TYPE (and sole original species): *Acrostichum graminoides* Swartz [= *Cochlidium graminoides* (Swartz) Kaulf.].

The date of the lectotypification of *Xiphopteris* is somewhat open to question. Kaulfuss erected the genus on the basis of two species, both of which had been described by Swartz in the same publication. Fée (Gen. Fil. 100. 1852) accepted Kaulfuss' genus but reduced *X. myosuroides* to synonymy with *X. serrulata*. It might be argued that since either name was available for application to his broader concept, Fée's selection of *X. serrulata* constituted implicit lectotypification. I maintain this not to be the case, as the type of neither species was excluded from

the genus. Had one name had priority, none would consider that the synonymizing of a later name constitutes typification. Alternately, if Kaulfuss had designated a type species, Fée would not have been obliged to select that name for his broader species concept. Therefore, conversely, his selecting a name should not imply the selection of a lectotype.

KEY TO THE SPECIES OF COCHLIDIUM

1. Sori compound, the receptacles linearly confluent and closely parallel to the costa.
2. Sori superficial, although at times protected by the conduplicately folded fertile lamina.
 3. Fertile portion of the frond abruptly contracted in width and long-acuminate; sterile lamina usually 3 mm or more wide (West Indies, South America)7. *C. seminudum*
 3. Fertile portion of the frond neither contracted nor acuminate; sterile lamina mostly less than 3 mm wide.
 4. Sterile veins forked; midrib not evident dorsally; fronds usually 2-3 mm wide (Brazil).
8. *C. punctatum*
 4. Sterile veins simple; midrib at least somewhat evident dorsally; fronds mostly less than 2 mm wide.
 5. Sterile veins short, reaching less than halfway to the margin; fronds 1 mm or less wide, more than 2 cm long.
 6. Fronds dichotomous (Jamaica)1. *C. graminoides*
 6. Fronds simple (South America)2. *C. pumilum*
 5. Sterile veins reaching more than halfway to the margin; fronds 1-3 mm wide, or if narrower than 1 mm, then less than 2 cm long.
 7. Laminal margins sinuate; sterile veins somewhat evident ventrally, terminating in conspicuous hydathodes (Cuba)5. *C. repandum*
 7. Laminal margins entire; sterile veins obscured; hydathodes present but scarcely conspicuous.
 8. Midribs distinctly prominulous ventrally; laminal trichomes 2-8-celled, not clavate; fronds mostly 1.5-3 mm wide and more than 2 cm long (Puerto Rico, Dominica) ... 6. *C. jungens*
 8. Midribs not prominulous ventrally; laminal trichomes 2-3-celled, the terminal cells enlarged; fronds mostly 1-1.5 mm wide and less than 2 cm long (Jamaica, Cuba) 4. *C. minus*
 2. Sori deeply immersed in a central groove.
 9. Hydathodes conspicuous; sporangial capsules less than 250 μm long; distal annulus cells less than 45 μm high; spores less than 43 μm in diameter (widespread)9. *C. linearifolium*
 9. Hydathodes obscure, usually not evident with 20 \times magnification; sporangial capsules more than 250 μm long; annulus cells more than 45 μm high; spores more than 43 μm in diameter (widespread)10. *C. rostratum*
 1. Sori separate, round or oval, often confluent at maturity but with discrete receptacles easily visible with the sporangia removed.
 10. Sterile fronds and the sterile portions of fertile fronds distinctly serrate or acutely lobed (widespread) 3. *C. serrulatum*
 10. Sterile laminae entire or repand.
 11. Fronds 1 mm or less wide, entire, somewhat distant on slender, creeping rhizomes; stomata mostly less than 57 \times 45 μm . (Venezuela) 16. *C. wurdackii*
 11. Fronds more than 1 mm wide or repand, tufted; stomata mostly larger than 55 \times 45 μm .
 12. Laminal margins provided with numerous 2-4-celled hairs (Jamaica) 11. *C. proctorii*
 12. Laminal margins with few or no hairs.
 13. Laminae membranous, with the dark perivascular sclerenchyma of the midrib exposed dorsally; fronds usually forked; sporangial capsules, including the annulus, usually less than 140 μm long (South America) 12. *C. furcata*
 13. Laminae coriaceous, dorsally with midrib prominulous but covered with laminal tissue; fronds mostly unforked; sporangial capsules usually more than 140 μm long.

14. Fronds 2.5-4 mm wide, entire, mostly with 2 regular rows of sori which at maturity are not confluent across the midrib (South America) 13. *C. tepuiensis*
14. Fronds 1-3 mm wide, entire or sinuate, either with sori irregularly disposed or all completely confluent at maturity.
15. Margins of the sterile laminae sinuate; fronds 1-2 mm wide (Venezuela) . 14. *C. acuminata*
15. Margins of the sterile laminae entire; fronds mostly 1.5-3 mm wide.
16. Mature sporangial capsules obpyriform, mostly 180-200 μm long; fertile laminae flat (South America) 15. *C. connellii*
16. Mature sporangial capsules globose, mostly 150-180 μm long; fertile laminae at times conduplicately folded over the sori (Puerto Rico, Dominica) 6. *C. jungens*

- **1. *Cochlidium graminoides* (Swartz) Kaulf. Enum. Fil. 86. 1824.**

Acrostichum graminoides Swartz, Prodr. Fl. Ind. Occ. 128. 1788. TYPE: Jamaica, Swartz s.n. (S not seen; isotypes C, L—these *fide* C. Chr. 1929, BM not seen, photo and fragment at US!).

Grammitis graminoides (Swartz) Swartz, Syn. Fil. 22. 1806.

Asplenium graminoides (Swartz) Swartz, Fl. Ind. Occ. 3: 1608. 1806.

Monogramma ? furcata Desv. Ges. Naturf. Freunde Berlin Mag. 5: 303. 1811, *nom. nov. et superfl.*

TYPE: Based on *Acrostichum graminoides* Swartz.

Pleurogramme graminoides (Swartz) Fée, Mém. Foug. 3: 37. 1852.

Taenitis graminoides (Swartz) Mett. Fil. Lips. 27. 1856.

Monogramma graminoides (Swartz) Baker in Hook. & Bak. Syn. Fil. 375. 1868, as *Monogramme*.

Pleurogramme furcata (Desv.) J. Smith, Hist. Fil. 178. 1875.

RANGE AND HABITAT: Jamaica. According to Proctor (1953), this species occurs locally on the eastern slope of the John Crow Mountains, at elevations of 2000-3000 ft.

Proctor's collection represents the only reported gathering of this species in this century. It is otherwise known only from Swartz's original collection and from a few plants collected by James Wiles around the turn of the nineteenth century. As I have not seen the Proctor plants and since the few specimens available to me are fragmentary, I have little to add to Christensen's (1929) account of this species. However, it should be noted that despite the implication to the contrary in Christensen's key, the fertile lamina is at times conduplicately folded over the sori.

SPECIMEN EXAMINED:

JAMAICA: "Near the top of the blue-mountain," Wiles (BM not seen, K not seen, photo US, US!).

- **2. *Cochlidium pumilum* C. Chr. Dansk Bot. Ark. 6(3): 19. 1929.**

TYPE: Chuquiribamba, Ecuador, 9 Sept 1868, *Masse* s.n. (K not seen).

RANGE: Colombia, Ecuador, Bolivia, Brazil.

Although I have not seen the type, the collections cited closely match Christensen's description. The species seems to be rare, but is clearly wide-ranging.

I agree with Christensen that this species must be very closely related to *C. graminoides*, but the discovery of additional material reinforces the assumption that the two are distinct. *Cochlidium pumilum* generally exhibits unforked fronds and strongly conduplicate fertile laminae. Also, judging from the material seen, the coenosorus is often interrupted in this species, but is rarely so in *C. graminoides*.

SPECIMENS EXAMINED:

COLOMBIA: *Acosta-Arteaga* 689 (NY). **BOLIVIA:** New Brazil, 5500 ft, *R. S. Williams* 1171. **Songo, Bang** 907B (NY, US). **BRAZIL:** *A. Richard* in 1834 (NY).

3. *Cochlidium serrulatum* (Swartz) L. E. Bishop, comb. nov.

Acrostichum serrulatum Swartz, Prodr. Fl. Ind. Occ. 128. 1788. TYPE: Jamaica, Swartz s.n. (S not seen; isotype US!).

Grammitis serrulata (Swartz) Swartz, J. Bot. (Schrader) 1800(2): 18. 1802.

Gymnopteris serrulata (Swartz) Bernh. Neues J. Bot. 1(2): 48. 1805.

Asplenium serrulatum (Swartz) Swartz, Fl. Ind. Occ. 3: 1607. 1806.

Xiphopteris serrulata (Swartz) Kaulf. Farnkr. 87. 1827.

Micropteris serrulata (Swartz) Desv. Mém. Soc. Linn. Paris. 6: 217. 1827.

Micropteris orientalis Desv. Mém. Soc. Linn. Paris 6: 217. 1827.

TYPE: Mascarene Islands, without collector (presumably P not seen).

Polypodium serrulatum (Swartz) Mett. Fil. Lips. 30. 1856, non Swartz, 1802, nom. illeg.

Xiphopteris extensa Fée, Mém. Foug. 11: 14, t. 19, f. 3. 1866. TYPE: Guadeloupe, L'Herminier in 1864 (presumably RB or P not seen).

Xiphopteris orientalis (Desv.) Fourn. Compt. Rend. Hebd. Séances Acad. Sci. 81: 1140. 1875.

Polypodium duale Maxon, Contr. U.S. Natl. Herb. 16: 61. 1912, nom. nov. TYPE: Based on *Acrostichum serrulatum* Swartz.

Xiphopteris auyantepuiensis Vareschi, Fl. Venez. 1(2): 879. 1969. TYPE: Auyán-tepuí, Edo. Bolívar, Venezuela, 1800 m, Vareschi & Foldats 4806 (VEN not seen). ISOPARATYPE: Auyán-tepuí, Edo. Bolívar, Venezuela, 1800 m, Vareschi & Foldats 4813 (US!).

RANGE AND HABITAT: Ranges throughout the West Indies and from the Mexican state of Puebla south to Bolivia. In the Old World it is known from the wetter parts of tropical Africa, Madagascar, the Mascarene Islands, and Amsterdam Island. Epiphytic and epipetric on mossy rocks. It is most frequently encountered at altitudes of 500-1500 m.

Cochlidium serrulatum is probably the most common species of the family in the New World. In spite of its small size, it is one of the most abundant in collections, and no species has a wider range. As is often the case with widespread species, considerable variability can be detected within the taxon as it is generally circumscribed. However, to date no one has successfully demonstrated the distinctiveness of any proposed segregates.

The type of *Micropteris orientalis* is uncertain. However, a collection in the de Jussieu herbarium at Paris (Ile de France et Bourbon, *de Petit Thouars* s.n. in 1808 (photo US) may represent an isotype at least. But in any case, no Indian Ocean specimens I have seen warrant taxonomic distinction on the basis of the characters that have been studied.

I suspect that Fée described *X. extensa* because he had previously confused Swartz's *Acrostichum serrulatum* with the same author's *Polypodium myosuroides* and had combined the two names under *X. serrulata* (Swartz) Kaulf. He therefore provided a new name for the concept of the present species. Although I have seen no type material of *X. extensa*, Fée's illustration is as usual quite good and leaves little doubt as to the application of the name.

The original description of *X. auyantepuiensis* Vareschi was based on two collections. No type was selected, and so the name remained invalid until the publication cited above. The duplicate of the paratype at US seems well within the range of variability of the species as a whole. Vareschi emphasized the dimorphic fronds to characterize *X. auyantepuiensis*. But in most specimens of *C. serrulatum*, the sterile fronds are shorter and more deeply lobed than the fertile ones.

In considering the morphological plasticity of this species, it should be pointed out that Walker (1966) indicated his Jamaican sample of the species to be an apogamous tetraploid. This account alone is sufficient to suggest that such a wide-ranging and variable taxon might be biosystematically complex. It would not be surprising if a carefully detailed study demonstrated that our present "species" consisted of two or more cryptospecies and hybrids between them.

To transfer the type species of a genus so well-known as *Xiphopteris* demands more than ordinary justification. Copeland (1947, 1952) strongly emphasized the restriction of the sori to a distal, nearly entire portion of the lamina in proposing an intimate relationship of *X. serrulata* with *X. myosuroides* and related species. But as I have discussed elsewhere (Bishop, 1974), laminar dissection is a weak character for the determination of species relationships in the Grammitidaceae. The *X. myosuroides* group shows clathrate scales, a solenostelic rhizome and a peculiar type of foliar trichome very different from that of *C. serrulatum* or other species of *Cochlidium*. In addition, the sori are merely impressed into the fertile lamina; the laminar margins are never conduplicately folded around the soral region. The necessary nomenclatural adjustments for the species normally included in *Xiphopteris* are being made elsewhere.

Aside from the conspicuously serrate or serrate-lobate fronds, *C. serrulatum* differs further from the other species of *Cochlidium*. The rhizome is relatively long-creeping with somewhat distant fronds, a character found otherwise only in *C. wurdackii*. The 2-4-celled laminar hairs are unusual in the genus in that the terminal cell is considerably elongated and the intercellular walls are somewhat less thickened. These trichomes seem to be nearly or quite lacking in many specimens. The hydathodes are much less conspicuous than in other species. In fact, they have been visible to me with certainty only in microscopic preparations. As they frequently are not situated over the terminus of the veins, the hydathodes may be vestigial in this species.

In view of the distinctiveness of this species, it might reasonably be retained in its own monotypic genus. However, since it is clearly related to the other species of *Cochlidium*, I prefer to include it here. But in any case, I feel sure that *C. serrulatum* cannot be retained justifiably in any generic concept which includes other species usually referred to *Xiphopteris* unless the entire family be construed to constitute a single genus.

One specimen from Venezuela merits special mention (*Steyermark & Nilsson* 264-A). This plant reveals its affinity to *C. serrulatum* through its elongate rhizome and the low serrations on some of the leaves. Other fronds, however, are quite entire. More significantly, the fertile lamina is scarcely expanded or conduplicate and is conspicuously narrower than the mature sori. These characters remove the plant from the usual range of variation of the species and suggest possible hybridization with one of the Venezuelan species with polypodioid sori.

REPRESENTATIVE SPECIMENS EXAMINED:

CUBA: Oriente: Sierra Nipe, near Woodfred, 450-550 m, *Shafer* 3432. **HAITI:** Massif du Nord, Anse-à-Foleur, top of Morne Colombeau, 900 m, *Ekman* H4368. **DOMINICAN REPUBLIC:** Loma de la

Sal, Jarabacoa, 1100 m, *Liogier 11356*, 1100-1400 m, *Liogier 11691*. **JAMAICA: Portland:** E slope of John Crow Mountains ca. 5 mi SW of Priestman's River, *Proctor 4294*. **PUERTO RICO:** Serra de Naguabo, Monte El Duque, *Shafer 2246*. **ST. KITTS:** Slopes of Mt. Misery, *Britton & Cowell 500*. **NEVIS:** Nevis Peak, 900-1095 m, *A. C. Smith 10552*. **MONTserrat:** Top of Chaners Mountain, 3000 ft, *Shafer 292*. **GUADELOUPE:** Bains Jaunes, 700 m, *Questel 1797*. **DOMINICA:** Lower slope of Morne Micotrin, Laudat, 700 m, *Hodge & Hodge 2095*. **MARTINIQUE:** Calebasse, Deux Choux, *Duss 1609*. **ST. LUCIA:** Vicinity of Mt. Gimie, ca. 1500 ft, *Webster, Ellis & Miller 9416*. **ST. VINCENT:** Soufrière, 2400 ft, *Eggers 6709*. **GRENADA:** Vicinity of Grand Etang, 1600-1800 ft, *Proctor 17049*. **TRINIDAD:** *Fendler 81* in 1877-78.

MEXICO: Veracruz: Zacuapan, *Purpus 3021*. **Puebla:** Barranca below Honey Station, *Pringle 13853*. **Oaxaca:** Dto. Teotitlan, Mun. de Tenango, First half of trail from S. Martín Caballero to Tenango, 4300-5000 ft, *Hallberg 1437*. **Chiapas:** Mun. de Ocosingo, near Laguna Ocotál Grande, ca. 25-30 km SE of Monte Líbano, ca. 950 m, *Dressler 1641*. **GUATEMALA: Huehuetenango:** Sierra de los Cuchumatanes, vicinity of Maxbal, 1500 m, *Steyermark 48782, 48886*. **Alta Verapaz:** Cerro Sillab, Senahu, *Hatch & Wilson 169*. **Izabal:** Montaña del Mico, between Milla 49.5 and ridge 6 mi from Izabal, 65-300 m, *Steyermark 38627*. **San Marcos:** S-facing slopes of Volcán Tajumulco, along the Río Chopal, Finca El Porvenir, 1300-1500 m, *Steyermark 37465*. **Chiquimula:** Volcán Ipala, near Amatillo, 900-1510 m, *Steyermark 30511*. **BELIZE:** Mountain Pine Ridge, *Bartlett 11642*. **HONDURAS: Cortés:** Lake Yojoa, near Agua Azul, 650 m, *Williams & Molina 17877*. **Atlántida:** Lancetilla Valley near Tela, *Standley 56353*. **COSTA RICA: Guanacaste:** Vicinity of Tilarán, 500-650 m, *Standley & Valerio 44565*. **Puntarenas:** Biological Field Station at Finca Wilson, 5 km S of S. Vito de Java, 1300-1400 m, *Lellinger 807*. **Alajuela:** Near Artzalea and Methodist Rural Center, ca. 8 km NE of Villa Quesada, 550 m, *Molina et al. 17748*. **Limón:** Alto Lari, 600 m, *Jiménez M. 1888*. **Heredia:** Río Sarapiquí near Cariblanco, N of Volcán Poás, 850 m, *L. O. Williams 20246*. **San José:** Near Tarbaca, ca. 15 km S of S. José, 1900 m, *L. O. Williams 19441*. **Cartago:** Estrella, 20 mi S of Cartago, 5200 ft, *Stork 3297*. **PANAMA: Chiriquí:** Vicinity of El Boquete, 1000-1500 m, *Cornman 910, 952, 1028, 1109, 1238, 1239*. **Panama:** La Eneida, region of Cerro Jefe, *Dressler 3315*. **Darién:** Cerro Mali base camp in the Serranía del Darién, 1400 m, *Gentry & Mori 13776*.

VENEZUELA: Nueva Esparta: Island of Margarita, Juan Griego trail, 450 m, *Johnston 144*. **Aragua:** Between El Portachuela and Ocumare, *Pittier 11384*. **Falcon:** Near Santa Ana, Cerro Santa Ana, 750 m, *Steyermark & Braun 94647*. **Bolívar:** Vicinity of Upper Falls of the Río Tirica above Summit Camp, central section of the Chimantá Massif, 1940-1950 m, *Steyermark & Wurdack 531*. **Amazonas:** 1-3 km N of Cumbre Camp, Río Yatua, Cerro de la Neblina, 1700-1800 m, *Maguire et al. 37228*. **COLOMBIA: Norte de Santander:** Sarare region, El Indio, along a branch of the Río Cubugón, 420-480 m, *Cuatrecasas 13064*. **Santander:** Valley of Quebrada Chima in the mountains W of Chima, 7700 ft, *Fassett 25549*. **Cundinamarca:** Caracha Range, E of Ibama, 13 km E of Yacopí, 2200 m, *Grant 9183*. **Meta:** Río Manzanares Valley, 30 km W of La Esperanza and 52 km W of Villavicencio, 1200 m, *Grant 10106*. **Vaupés:** Río Piraparaná (tributary of the Río Apaporis), *Schultes & Cabrera 17560*. **Caquetá:** Sucre, *Juzepczuk 6514*. **Amazonas:** Near the mouth of the Río Popeyacá (tributary of the Río Apaporis between the Río Piraparaná and Raudal Yayacopi), ca. 700 ft, *Schultes & Cabrera 16182*. **Huila:** Mosquera, 8900 ft, *Little 7715*. **Chocó:** Between Palestina and Agua Negra, Río S. Juan, 5 m, *Cuatrecasas 21555*. **El Valle:** La Cumbre, 1700-2200 m, *Killip 11318*. **Nariño:** S end of Gorgona Island, ca. 0 m, *Killip & García 33106*. **ECUADOR: Esmeraldas:** Parroquia de Concepción, El Sajado on the Río Santiago, 70 m, *Mexia 8449*. **Pichincha:** Quito-Sto. Domingo Road, ca. 1200 m, *Haught 3219*. **Napo-Pastaza:** Between Baños and Mera, 400-500 m, *Mexia 6966*. **Santiago-Zamora:** Valley of the Río Negro and Río Chupianza, on the trail from Sevilla de Oro to Mendez, between Hda. Chontal and Sta. Elena, 3400-4600 ft, *Camp E-809*. **PERU: San Martín:** Top of ridge E of Tingo María, 1020 m, *Allard 21476, 21489*. **Loreto:** Sierra del Pongo, 800 m, *Mexia 6287*. **Huánuco:** Tingo María, 700 m, *Tryon & Tryon 5331*. **Junín:** E of Quimiri Bridge near La Merced, 800-1300 m, *Killip & Smith 23886*. **Cuzco:** Valley of Cosñipata between Yanamayo and Sta. Isabel, ca. 1500 m, *Scolnik 863*. **BOLIVIA: La Paz:** S. Antonio, near Mapiri, 850 m, *Buchtien 1097*. **BRAZIL: Amazonas:** Track from Km. 63, Manaus-Itacoatiara road, *Prance et al. 9079*. **Roraima:** Vicinity of Auaris, 760-800 m, *Prance et al. 9594*. **Minas Gerais:** S. João, *Lindman A181*. **Rio de Janeiro:** Monte do Cochrane, 20-300 m. *L. B. Smith 1348*. São

Paulo: Morro Jaraguá, 1000 m, *A. C. Brade 6590*. **Paraná:** Serro do Embeque, 1200 m, *Hatschbach 24951*. **Sta. Catarina:** Morro do Baú, Itajaí, 700 m, *Reitz 3017*. **FRENCH GUIANA:** May 1831, *Leprieur*. **SURINAM:** Brownsberg, 400 m, *Gonggerijp & Stahel 320*. **GUYANA:** Trail from Kaieteur Falls to Tukeit, Potaro River Gorge, *Maguire & Fanshawe 23480*.

LIBERIA: Vicinity of Mt. Coffee, ca. 40 mi inland from Monrovia, 50-150 m, *Cook 122*. **MAURITIUS:** *Pike* in 1867. **MADAGASCAR:** Mont Papanga, 1600-1700 m, *Humbert 6944*.

~ **4. *Cochlidium minus* (Jenm.) Maxon, Sci. Surv. Porto Rico and Virgin Is. 6: 407. 1926.**

Monogramma minor Jenm. Bull. Bot. Dept., n. ser. 4: 212. 1897. TYPE: Murray's Flat, above Mt. Moses, St. Andrew Parish, Jamaica, *Jenman s.n.* in 1876. (NY!; isotype US!).

RANGE AND HABITAT: Jamaica and Cuba. Proctor (1953) describes this species as epipetric. One Cuban specimen is cited as "Epiphytic or terrestrial in dense clumps." Elevations on two sheets from Cuba are 1350 and 1400 m.

Of *C. minus* from Jamaica, I have seen only the type material. Evidently rare and local, this is also the smallest known species of the genus. Both Maxon (1926) and Christensen (1929) included here a number of specimens from Cuba and Puerto Rico that to me clearly belong to two other species, both undescribed.

SPECIMENS EXAMINED:

CUBA: Oriente: Palma Mocha, 1400 m, *Ekman 5211*. Crest of Sierra Maestra between Pico Turquino and La Bayamesa, 1350 m, *Morton & Acuña 3563*. S side of the crest of the Sierra Maestra W of Aserradero S. Antonio de las Cumbres, region of La Bayamesa, 1400-1500 m, *Morton 9591*.

~ **5. *Cochlidium repandum* L. E. Bishop, sp. nov.**

Filix parvula quae in saxibus arboribusque colonialiter crescens invenitur. Rhizoma ascendens, frondes approximatas et paleas 2-4 mm longas apicibus acuminatis ad basin cordatam per 8-12 cellulas latas ostendens. Stipites tenues atrobrunnei teretes 1-15 mm longi atque diametro 0.2-0.3 mm. Lamina 2-6 cm × 1.0-2.5 mm, chartacea vel subcoriacea, patula vel suberecta, ad apicem rotundata, basin versus acuminata, costa dorsaliter parum prominula vagina sclerotica eius plus minusve hic evidenti at ventraliter costa praecipue per longitudinem fertilem prominenti edenti venulas visibiles quae in hydathodos claras terminant, margine repando aut interdum subintegro, pilis 2-4 cellularibus in margine costaeque faciebus ambabus instructa, stomatibus abaxialibus 55-67 × 47-53 μm, sorifera per partem usque tertiam distalem hic limbo laminali plano aut circum soros conduplicato. Venae steriles simplices, illae fertiles basaliter receptaculares emittentes furcam itidem fertilem quae in venam proximam distalem jungit, hoc modo coenosorum efficientem. Coenosorus in laminam impressus, aliquando aliquantum interruptus. Sporangiorum capsulae subglobosae 100-120 × 95-110 μm, cellulae annuli 10-12, sporae 22-25 μm diametro.

✓**HOLOTYPE:** On tree fern bases, Arroyo del Medio, above the falls, Sierra de Nipe, Oriente, Cuba, 450-550 m, *Shafer 3473* (US).

PARATYPES: The following collections from Cuba at US are referable here: *Clément 4631, 4978, 6724, Acuña 12348, Pollard et al. 240, Shafer, 3475, 4110, 8072, 8159*.

RANGE AND HABITAT: Apparently confined to the eastern end of Cuba, Pcia. Oriente, from Sierra de Nipe to Baracoa. Judging from the number of collections, it must be at least locally common at middle altitudes. It is recorded growing on both trees and rocks.

Confounded by Christensen and Maxon with *C. minus* and *C. jungens*, this species is easily separated by the repand margin and other characters mentioned in the key. *Cochlidium minus* occurs in Cuba only in the Sierra Maestra, where *C. repandum* is absent. Apparently the two species grow at different elevations as well.

6. *Cochlidium jungens* L. E. Bishop, sp. nov.

Epiphytum parvum in sylvis muscosis vigenis. Rhizoma ascendens vel erectum nonnunquam ramosum ac caespitosum, frondibus stipitibusque confertis onustum, paleis 1.5-3 mm longis e basi truncata aut subcordata 8-12 cellulas lata usque ad apicem filiformem acuminate angustatis praeterea instructum. Stipites obsoleti vel usque 10 mm longi alati atrobrunnei 0.2-0.4 mm diametro. Lamina 2-8 cm × 1.5-3 mm, chartacea vel subcoriacea, vulgo erecta, ad apicem rotundata basin versus acuminata, costa utrinque prominula sed vagina atrofusca rarerer evidenti, in margine integro costaque utrinsecus pilis ex 2-8 cellulis constantibus illis interdum raris vel sub aetate provecta carentibus, stomatibus dorsalibus 65-82 × 52-62 μm, sorifera ad apicem vel frondis medio tenuis, hac lamina fertili expansa aut super sporangias conduplicata. Venae steriles plerumque simplices, illae fertiles saepe furcatae, receptaculares ad basem venae furcataeque acroscopicae, increbre furca receptaculari adjecta ad venam proximam jungenti et coenosorum facienti. Sporangia capsulis 150-180 × 150-170 μm, cellulis annuli 8-11, sporisque papillosis 26-31 μm diametro.

HOLOTYPE: Epiphytic in mossy forest, top of Morne Micotrin, St. George Parish, Dominica, 3800 ft, *Nicolson 1975* (US).

PARATYPES: The following are also at US: Dominica: *Webster 13376*; Puerto Rico: *Britton 7917*, *Hess 313*, *Hioram 335*, *Shafer 2245*, *3647*.

RANGE AND HABITAT: Dominica and Puerto Rico. Epiphyte in cloud forest, 800-1500 m elevation.

This is yet another species formerly confounded with *C. minus*. Actually, with its larger, erect and often crowded fronds, it is hardly even superficially like that species, and finer characters clearly separate the two. Nor does *C. jungens* show any more than a casual resemblance to *C. repandum* of Cuba.

Of interest in this species is the variation with respect to fusion of the sori. In some plants coenosoral development is complete. But in most the sori are separate, or else show various degrees of soral coalescence. Since some workers have felt the coenosorus to be critical in the generic delimitation of *Cochlidium*, I have chosen the epithet to emphasize that with respect to this character, the species with polypodioid sori are joined to those with coenosori by this species. However, this should not be taken to indicate that *C. jungens* is phylogenetically intermediate between the groups.

7. *Cochlidium seminudum* (Willd.) Maxon, *Sci. Surv. Porto Rico and Virgin Is.* 6: 407. 1926.

Blechnum seminudum Willd. *Phytogr.* 13, t. 8, f. 2. 1794. TYPE: Martinique, *Isert s.n.* in 1787 (B not seen; studied from microfiche no. 19587 of Herb. Willd.)

Grammitis seminuda (Willd.) Willd. *Sp. Pl.* 5: 140. 1810.

Taenitis graminifolia Hooker, *Exotic Fl.* 1: t. 77. 1823. TYPE: St. Vincent, *Guilding s.n.* (K not seen).

Taenitis pumila Kaulf. Enum. Fil. 132. 1824, *nom. nov. et superfl.* TYPE: Based on *Blechnum seminudum* Willd.

Taenitis linearis Kaulf. Enum. Fil. 131. 1824. TYPE: Guadeloupe, without collector (Herb. Sprengel, presumably destroyed).

Micropteris blechnoides Desv. Mém. Soc. Linn. Paris 6: 217. 1827, *nom. nov. et superfl.* TYPE: Based on *Blechnum seminudum* Willd.

Grammitis isertii Swartz, Adnotat. Bot. 65. 1829, *nom. nov. et superfl.*, as "*iserti.*" TYPE: Based on *Blechnum seminudum* Willd.

Pleurogramme graminifolia (Hooker) Presl, Tent. Pterid. 223. 1836.

Pleurogramme linearis (Kaulf.) Presl, Tent. Pterid. 223, t. 10, f. 2. 1836.

Pleurogramme pumila (Kaulf.) Presl, Tent. Pterid. 223. 1836.

Monogramma graminifolia (Hooker) Hooker, Sp. Fil. 5: 124. 1864, as "*Monogramme.*"

Taenitis seminuda (Willd.) Kuhn, Fil. Afr. 59. 1868.

Pleurogramme seminuda (Willd.) J. Smith, Hist. Fil. 178. 1875.

Pleurogramme nuda Goebel, Flora 117: 119. 1924.

RANGE AND HABITAT: Jamaica, Hispaniola, Puerto Rico, Lesser Antilles, Trinidad, and Venezuela. Christensen (1929) also cites specimens from French Guiana. Due to the usual confusion about Isert's specimens, nineteenth century authors also assigned the species to Africa, where it does not exist.

Cochlidium seminudum is a fairly common, widespread, and larger member of the genus. As a result, it has had an appropriately checkered taxonomic history.

Hooker described *Taenitis graminifolia* without reference to Willdenow's species, suggesting only that it might be identical with *Grammitis graminoides* (= *Cochlidium*) of Jamaica. Although I have not seen type material, the illustration is good and no species is known from St. Vincent superficially similar to *C. seminudum*.

Willdenow's type is a small plant of this species. Kaulfuss assigned the name *Taenitis pumila* to this specimen and differentiated his *Taenitis linearis* as being twice as large and stipitate. The type was undoubtedly destroyed along with the rest of the ferns of Sprengel's herbarium, so that the application of the name can never be certain. However, assuming that it represents an otherwise known taxon, one part of Kaulfuss' description, "Frons . . . hinc [e medio] angustata in caudam elongatam producta," could only apply to this species.

Presl erected his genus *Pleurogramme* to include both of Kaulfuss' species as well as Hooker's *T. graminifolia*. Therefore, all three names in Presl's genus are reducible to a single species concept.

As pointed out by Christensen, Goebel (1924) sought to clear the confusion of this species with *C. punctatum*. The Brazilian plants frequently had been included in the same species concept as the Caribbean *C. seminudum* by nineteenth century workers, but Goebel clearly established the two populations as distinct. Unfortunately, he applied the name *Pleurogramme seminuda* to the Brazilian species and gave the new name *Pleurogramme nuda* to the Caribbean population. No type was cited, but the intended application of the name is obvious.

The most distinctive characteristic of this species is the constriction of the lamina through the fertile portion. No other species exhibits this feature. The sori are impressed into the dorsal surface, but the limb of the fertile lamina is usually

flat. Only rarely is it conduplicately folded around the sporangia. In such cases, the fertile portion is generally falcate as well.

REPRESENTATIVE SPECIMENS EXAMINED:

JAMAICA: Portland: E slope of the John Crow Mountains 1.5-2.5 mi SE of Ecclesdown, 1500-2500 ft, *Proctor 10491*. **HISPANIOLA: Samaná:** Top of Pan de Azucar, ca. 510 m, *Ekman H14883*. **PUERTO RICO:** El Yunque, Serra de Luquillo, 2500-3000 ft, *Chase 6730c*. Loma Icaco, Sierra de Naguabo, 210-675 m, *Shafer 3457*. **ST. KITTS:** Molyneux Estate, *Britton & Cowell 684*. **NEVIS:** Nevis Peak, summit and adjacent ridge, 900-1095 m, *A. C. Smith 10559*. **MONTSERRAT:** Upper W spur of Chance's Mountain, 2000-3000 ft, *Proctor 19102*. **GUADELOUPE:** Bains Jaunes, 600 m, *Questel 2003*. **DOMINICA:** Vicinity of Fresh Water Lake near Laudat, 450-600 m, *A. C. Smith 10303*. **MARTINIQUE:** Deux Choux, 460 m, *Stehlé 3423*. **ST. VINCENT:** Soufrière, 2000 ft, *Eggers 6857*. **GRENADA:** *Sherring 96*. **TRINIDAD:** *Bot. Gard. Herb. 1259*.

VENEZUELA: Nueva Esparta: San Juan Mountain, Island of Margarita, 600 m, *Johnston 186*. **Sucre:** NE of Güiria, N of Puerto de Hierro, Cerro Patao, Peninsula de Paria, 800-825 m, *Steyermark & Agostini 91125*.

8. *Cochlidium punctatum* (Raddi) L. E. Bishop, comb. nov.

— *Grammitis punctata* Raddi, Pl. Bras. 1: 11, t. 22, f. 1. 1825. TYPE: Brazil, *Raddi s.n.* (presumably PISA not seen).

Polypodium ? punctatum (Raddi) Hooker, Sp. Fil. 4: 172. 1862.

Grammitis paucinervata Fée, Crypt. Vasc. Brés. 2: 51, t. 96, f. 1. 1873. TYPE: Pico da Tijuca, Est. Rio de Janeiro, Brazil, *Glaziou 5384* (presumably RB not seen; isotypes B, C—*fide* C. Chr., NY!).

Monogramma rudolfii Rosenst. Festschr. Alb. v. Bamberg 63. 1905. SYNTYPES: Tresbarraserra, Est. Sta. Catharina, Brazil, 900 m, *Schmalz 162* (S; isosytype NY!); Rio Grande, Est. São Paulo, Brazil, *Wacket 45* (S; isosytype NY!).

Polypodium paucinervatum (Fée) C. Chr. Ind. Fil. 332. 1905.

Cochlidium paucinervatum (Fée) C. Chr. Dansk Bot. Ark. 6(3): 22. 1929.

RANGE AND HABITAT: Southeastern Brazil, known from the states of Minas Gerais, Rio de Janeiro, São Paulo, Paraná, and Sta. Catarina. Epiphytic or occasionally epipetric, at 400-1300 m elevation.

It is unfortunate that Christensen (1929) adopted Fée's epithet for this species, even though admitting the probable identity of Raddi's earlier species. He states, "As to some points Raddi's description and figure do not agree perfectly with *C. paucinervatum*, and I therefore prefer not to use Raddi's specific name although it is fully available and although I believe that his species is identical with *Gr. paucinervata*." Although I sympathize with Christensen's reluctance to adopt a species whose type he had not seen, in this case I believe it to be justified and necessary.

Raddi's plate is quite good. It shows well the general habit of this species. The only abnormality exhibited, and the one which no doubt disturbed Christensen, is that one of the three fertile fronds is shown with a discontinuous coenosorus. But this is not uncommon in species of the genus with coenosori, and the other two fronds show continuous soriation. Another point concerning the drawing is that the fronds in ventral view show conspicuous hydathodes; indeed, these are celebrated in Raddi's name. These dark, very evident hydathodes constitute a conspicuous feature of many, but not all, specimens of this Brazilian species.

Geographical evidence for the identity of Raddi's species may also be cited. No other remotely similar species is known to occur in southeastern Brazil, but the present one must be fairly common. Raddi did much of his collecting in the area of

Rio de Janeiro, well within the species' range. It seems most unlikely that he gathered a very similar species collected by no subsequent worker but failed to notice the one in question.

In contrast to Raddi's drawing, that of Fée is almost unidentifiable. Even the Glaziou collection on which it is based is so depauperate that attention to microcharacters and a consideration of range are necessary to make a reasonable assignment to species. Interestingly enough in the light of the above discussion, the NY plant has round sori that appear superficially polypodioid, and Fée's species was so described. This condition, though, seems best explained by considering the material subfertile.

Monogramme rudolfii Rosenst. was based on two syntypes. Duplicates of each at NY belong clearly to the present species concept. But since I have not seen the original material and since the selection seems not immediately necessary for nomenclatural purposes, I decline to designate a lectotype.

Goebel (1924) presented a detailed comparison of this species with the Caribbean *C. seminudum*. To his distinctions I would add that the rhizome scales of *C. punctatum* are generally 20-30 cells wide at the base, whereas those of *C. seminudum* are half as many cells wide. The lamina of the latter species is abruptly contracted through its fertile length, whereas that of the former is of uniform width. The sporangial capsules of the Brazilian plant are somewhat obpyriform and 200-250 μm long; those of *C. seminudum* globose and 100-150 μm long.

As Goebel pointed out, the fertile veins generally do not quite fuse in this species. This provides yet another example of imperfect coenosoral development. However, this discontinuity is usually discernible only in cleared specimens and is scarcely detectable externally.

REPRESENTATIVE SPECIMENS EXAMINED:

BRAZIL: Minas Gerais: Bello Horizonte, Serra do Piedade, 1300 m, *Foster & Foster 556*. Rio de Janeiro: Itatiaia National Park, S face of Mt. Itatiaia, *Eiten & Eiten 7524-C*. São Paulo: Rio Grande, Aug 1913, A. C. Brade. Paraná: Serra do Capivary Grande, *Hatschbach 8235*. Sta. Catarina: Tresbarraserra, 1000 m, *Schmalz (Ros. Fil. Austrobras. Exs. 73)*.

9. *Cochlidium linearifolium* (Desv.) Maxon ex C. Chr. Dansk Bot. Ark. 6(3): 23. 1929.

Monogramma linearifolia Desv. Ges. Naturf. Freunde Berlin Mag. 5: 302. 1811. TYPE: French Guiana, without collector (P not seen).

Grammitis linearifolia (Desv.) Steudel, Nomencl. Bot. 2: 187. 1824.

Pleurogramme immersa Fée, Mém. Foug. 3: 37. 1852, *nom. nov. et superfl.* TYPE: Based on *Monogramma linearifolia* Desv.

Pleurogramme linearifolia (Desv.) Moore, Ind. Fil. xxvii. 1857.

Monogramma immersa (Fée) Hooker, Sp. Fil. 5: 125. 1864, as "*Monogramme*."

RANGE AND HABITAT: I have seen specimens from Guatemala, Belize, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Guyana, and Brazil. Christensen (1929) reports it from Tovar, Venezuela. Although this species is to be expected in Venezuela, I suspect any specimen from the elevation of Tovar would likely be *C. rostratum*. I have seen no material from the Caribbean, where Christensen reports specimens from Cuba, Haiti, and Guadeloupe. The Ekman

collection from Haiti is definitely *C. rostratum*, and the others need re-examination. *Cochlidium linearifolium* is an epiphytic species of the lowlands, attaining a maximum elevation of 800 m.

Neither Christensen nor I have seen Desvaux's type. However, because of the preference of *C. rostratum* for high elevations, I think it unlikely that the specimen represents that species. Another possibility is that of confusion with *C. seminudum*, which is reported from French Guiana. There is nothing in Desvaux's description to indicate difference from this species, except the note that the fronds are subfalcate. This is very rarely the case in *C. seminudum*, whereas falcate fronds are common in *C. linearifolium*.

This species has been difficult to distinguish from *C. rostratum*. By recognizing the altitude difference, it has been possible to correlate the prominent hydathodes with smaller sporangial measurements, and therefore to give a better circumscription of the concept than did Christensen, whose venation characters do not hold in my preparations. But the situation is not so clear-cut as would be liked. For instance, the two Costa Rican specimens I have assigned here are really intermediate, both in characters and elevation.

The capsules of specimens included here are often little more than half the size of those of *C. rostratum*, and the stomata generally are smaller as well. This suggests a difference in chromosome number between the two species. I suspect that cytological investigation might show more biosystematic complexity in this area of the genus than can be detailed from herbarium material alone.

REPRESENTATIVE SPECIMENS EXAMINED:

GUATEMALA: Alta Verapaz: Cubilquitz, 350 m, von Tuerckheim 8372. **BELIZE:** Mountain Pine Ridge, Bartlett 11762. **HONDURAS:** Cortés: E shore of Lake Yojoa, 360 m, Williams & Molina 11441. **NICARAGUA:** SE of La Tronquera, 50 m, Molina 15003. **COSTA RICA:** Puntarenas: Osa Peninsula on ridge 9.5 km W of Rincón de Osa, 600 m, Lellinger 676. **San José:** S. Isidro del General, 2500 ft, Stork 3106. **PANAMA:** Panama: Cerro Jefe, 10 mi S from Goofy Lake in Cerro Azul, Correa & Dressler 171-B. **Darién:** Summit of Cana, 2500 ft, Stern et al. 533.

COLOMBIA: Amazonas-Vaupés: Jinogojé, Río Apaporis, Schultes & Cabrera 16742. **Chocó:** Corcovada Region, upper Río San Juan, 200-275 m, Killip 35341. **Valle:** Buenaventura, 0-10 m, Killip 11723. **BRAZIL:** Amapá: Rio Iaue 0.5 km E of confluence with the Rio Oiapoque, Irwin et al. 47926. **Pará:** Vicinity of Cachoeira, Km. 96 of Road BR 22, Capanema to Maranhão, Prance & Pennington 1705. **FRENCH GUIANA:** May 1838, Leprieur. **GUYANA:** Ex herb. Jenman.

10. *Cochlidium rostratum* (Hooker) Maxon ex C. Chr. Dansk Bot. Ark. 6(3): 23. 1929.

Monogramma rostrata Hooker, Sp. Fil. 5: 122. 1864, as "*Monogramme*." TYPE: Omotepee, Nicaragua, Wright s.n. (K not seen; isotype US!). Hooker cites the location as "Island on the Lake Omotepec." Omotepee (now usually spelled Ometepe) is an island in Lago de Nicaragua.

?*Pleurogramme gyroflexa* Christ in Pittier, Prim. Fl. Costar. 3(1): 10. 1901. TYPE: Valley of the Río General, Pcia. S. José, Costa Rica, 700 m, Pittier 12061 (BR or P not seen).

?*Monogramma gyroflexa* (Christ) C. Chr. Ind. Fil. 430. 1906.

Cochlidium rostratum var. *areolatum* C. Chr. Dansk Bot. Ark. 6(3): 25. 1929. TYPE, Morne Colombeau, Anse-à-Foleur, Haiti, Ekman H-4376 (BM not seen; isotype US!).

RANGE AND HABITAT: Cuba, Jamaica, Hispaniola, Guadeloupe, Mexico (Oaxaca), Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, Venezuela, and Colombia. Epiphytic, at 700-2600 m elevation.

The type represents an extreme form. The sterile lamina is narrow and erect, the fertile strongly conduplicate, falcate, and with a long, sterile apex or "rostrum." I agree with Christensen (1929) that there seem to be all intermediates between this and the forms with wider, laxer, and flat leaves. He took plants of the latter sort to be representative of *Pleurogramme gyroflexa* Christ, although he did not indicate that he had seen the type. This type needs checking; the elevation given in the original description is low for *C. rostratum*, and most workers have not distinguished this species well from *C. linearifolium*.

Christensen removed all Caribbean material to his variety *areolatum*, which was characterized solely by the usually anastomosing veins. The venation is visible only in cleared specimens, and I have found such areolation to be rather casual in my preparations. Since these plants are not otherwise different from those of continental populations, I believe a variety based on such a weak, occult character to be trivial.

The single Mexican specimen that I have seen (*Mickel 914*) needs special mention. The hydathodes are quite conspicuous, as in *C. linearifolium*. In addition the sporangia are a bit small for *C. rostratum* (240-270 μm). However, I retain it here on the basis of the large spores (50-55 μm) and the elevation (ca. 7000 ft.). Certainly the population merits closer study.

REPRESENTATIVE SPECIMENS EXAMINED:

CUBA: Oriente: Crest of the Sierra Maestra between Pico Turquino and La Bayamesa, 1350 m, *Morton & Acuña 3549*. **JAMAICA: Portland:** John Crow Peak, 6000 ft, *Fawcett*. **HAITI:** Marmelade, Morne Belle-Terre, Massif du Nord, ca. 1100 m, *Ekman H8211*. **GADELOUPE:** Bains Jaunes, 950 m, *Stehlé 341*, 800 m, *Stehlé 1096*.

MEXICO: Oaxaca: Valley of the Yelagago River ca. 20 mi NE of Villa Alta, 6800-7200 ft, *Mickel 914*. **GUATEMALA: Alta Verapaz:** Senahu, Cerro Sillab, *Hatch & Wilson 164*. **HONDURAS: Francisco Morazán:** Rancho Quemado, above S. Juancito, 2100 m, *L. O. Williams 18518*. **EL SALVADOR: Santa Ana:** El Trifinio, Cordillera Miramundo, 2000-2200 m, *Molina, Burger & Wallenta 16796*. **COSTA RICA: Alajuela:** Vicinity of Fraijanes, 1500-1700 m, *Standley & Torres 47486*. **Heredia:** Vara Blanca de Sarapiquí, 1750 m, *Skutch 3322*. **San José:** Las Nubes, 1500-1900 m, *Scamman 7260*. **Cartago:** Near La Sierra, ca. 25 km S of Cartago, 2000 m, *L. O. Williams et al. 28060*. **PANAMA: Chiriquí:** Between Alto de las Palmas and the top of Cerro de la Horqueta, 2100-2268 m, *Maxon 5514*.

VENEZUELA: Lara: Fila de Terepaima between Alto de Chuparral and la Loma Redonda, 21-23 km S of Cabudare, 1300-1460 m, *Steyermark et al. 103382*. **COLOMBIA: Meta:** Renjifo Massif, Cordillera La Macarena, 1300-1900 m, *Idrobo & Schultes 974*.

11. *Cochlidium proctorii* (Copel.) L. E. Bishop, comb. nov.

Grammitis proctorii Copel. Philipp. J. Sci. 80: 121. 1952, as "*proctori*." TYPE: East slope of John Crow Mountains, ca. 2 mi SW of Ecclesdown, Jamaica, 2000 ft, *Proctor 5642* (MICH not seen; isotypes IJ-fide Proctor 1953. US!).

RANGE AND HABITAT: Known only from the type locality. Epiphytic.

This is the only species of the genus outside South America with sori borne distally on the veins. Among this group of primarily Venezuelan species, it shares with *C. tepuiense* two regular rows of sori which are more or less separate at maturity. Like *C. attenuatum* it has a lightly repand margin, and the thinner texture and dorsally black midrib are similar to *C. furcatum*. *Cochlidium proctorii* has more abundant marginal hairs than other species of the genus. In *C. jungens* there are occasionally fairly numerous hairs, but this species is easily separable

from *C. proctorii* by its erect habit, thicker texture, green midrib, entire margin, and larger sporangial capsules (length 150-180 vs. 100-140 μm).

12. *Cochlidium furcatum* (Hook & Grev.) C. Chr. Dansk Bot. Ark. 6(3): 20. 1929.

Grammitis furcata Hook. & Grev. Ic. Fil. t. 62. 1828. TYPE: Guyana, Parker s.n. (K not seen).

?*Mecosorus nudus* Klotzsch, Linnaea 20: 405. 1847. SYNTYPES: Guyana, Rich. Schomburgk 1187, 1851 (B neither seen).

Polypodium furcatum (Hook. & Grev.) Mett. Abh. Senckenberg Naturf. Gesell. 2: 34. 1856, non Swartz, 1801 nec Desv., 1827 nec Roxb., 1844.

Polypodium dicranophyllum C. Chr. Ind. Fil. 331. 1905, nom. nov. TYPE: Based on *Grammitis furcata* Hook. & Grev.

Grammitis dicranophylla (C. Chr.) Vareschi, Fl. Venez. 1: 874. 1969, nom. illeg.

RANGE AND HABITAT: Guyana, Trinidad, Venezuela, Colombia, Brazil. Epiphyte at 600-2000 m elevation. Reports from Jamaica exist, but I have seen no specimens, Proctor (1953) does not mention it, and I doubt that it occurs there.

This and the following four species constitute a group whose taxonomic disposition is still unsatisfactory. The taxa remain refractory in spite of considerable effort to delimit the species on the basis of microscopic characters. I believe that hybridization is occurring here. This, coupled with the reduction of already small plants in exposed habitats, has resulted in a number of collections which I am unable to place with assurance. My treatment here is tentative and one which does least violence to existing species concepts and nomenclature.

Cochlidium furcatum and *C. tepuiense* are the two commonest, most distinctive, and most stable entities, although even they seem to intergrade with one another and each with other species. *Cochlidium attenuatum* and *C. connellii* exist as identifiable concepts, but are less discrete and more variable. I accept them as species partially because both names are available in the genus. *Cochlidium wurdackii* is a rare but distinct entity worthy of specific recognition. I feel strongly that only careful field observation, perhaps in conjunction with cytological data, will resolve the biosystematic problems with these species.

Although I have not seen the type of the present species, the specimen is fairly well illustrated and is from Guyana, where the species is widespread. In addition, this is the species most regularly having dichotomous fronds. Therefore, I believe the name to be properly applied.

Mecosorus nudus Klotzsch is more problematic. Copeland (1952) with good reason referred the name to *C. furcatum*, but neither of us have seen the type and the original description is hardly definitive. Schomburgk did collect from Mt. Roraima where *C. attenuatum* and *C. connellii* occur. Since the fronds are described as very rarely bifid, it is possible that the type material represents one of those species. It should be noted that Copeland (1947) suggested this species for the type of *Mecosorus*. The type, of course, must be *Polypodium persicariifolium* Schrad., as this was the type and sole species of the earlier *Microgramma* Presl, which Klotzsch illegitimately adopted as a section of his new genus.

Cochlidium furcatum is the only South American member of the genus with free, distally borne sori which has been found outside the Guyana Highlands. Other workers have emphasized the simple fertile veins and forked fronds to

define this species. Unfortunately, both simple fronds and forked fertile veins occur here, and forked fronds are found occasionally in the other species. Several other features help characterize this concept. The small sporangial capsules, mostly 110-140 μm long, well separate *C. furcatum* from all but *C. tepuiense*, which has capsules mostly 140-170 μm . The present species typically has the sori irregularly disposed and the lamina expanded around the receptacle, resulting in the fertile portion of the frond being irregularly repand. *Cochlidium tepuiense* has entire fronds bearing two regular rows of sori. The lamina of *C. furcatum* is much thinner than that of the following four species, and the dark perivascular sclerenchyma of the midrib is typically visible on the back. This character especially removes the species from *C. connellii*, which has thickly coriaceous fronds. The repand sterile lamina and very narrow fronds distinguish *C. attenuatum* and *C. wurdackii* respectively from *C. furcatum*. I have seen plants apparently intermediate between *C. furcatum* and each of the next three species.

REPRESENTATIVE SPECIMENS EXAMINED:

VENEZUELA: Bolívar: Salto de Iwaracarú-merú, at the W end of Sororopán-tepuí, 1615 m, *Steyermark* 60227. Amazonas: Vicinity of Base Camp, Cerro Sipapo (Paráque), *Maguire & Politi* 27943. **COLOMBIA:** Cundinamarca: Las Cascades, S side of Guavio River 18 km NE of Gachalá, 2070 m, *Grant* 10517. **Vaupés:** Río Piraparaná, *Schultes & Cabrera* 17069. **TRINIDAD:** Las Lapas Road, 2000 ft, *Homersley* 277. **SURINAM:** Hendriktop, 1080 m, *B. W.* 5709a. **GUYANA:** Below Tukeit, Potaro River Gorge, *Maguire & Fanshawe* 23484. **BRAZIL:** *Glaziou* 12368.

13. *Cochlidium tepuiense* (A. C. Smith) L. E. Bishop, comb. nov.

Polypodium tepuiense A. C. Smith in Gleason & Killip, *Brittonia* 3: 148. 1939. TYPE: Mt. Auyán-tepuí, Edo. Bolívar, Venezuela, 1850 m, *Tate* 1248 (NY!; isotype US!).

Grammitis tepuiensis (A. C. Smith) Vareschi, *Fl. Venez.* 1: 871. 1969.

RANGE AND HABITAT: Widespread in the highlands of SE Venezuela. Epiphytic, at 1000-2000 m elevation.

This is the largest of the Guyana Highlands group of species. It is best characterized by the broad fronds up to 3 mm wide bearing two regular rows of sori which at maturity may be confluent lineally but are separate across the midrib. The entire margin separates it from *C. furcatum* and *C. acuminatum*. The larger size and somewhat separate sori remove it from the present concept of *C. connellii*.

SPECIMENS EXAMINED:

VENEZUELA: Bolívar: Headwaters of the Río Venamo, northern slopes of Cerro La Danta, NW of Cerro Venamo, 1040 m, *Steyermark & Nilsson* 53. Headwaters of the Río Chicanán 80 km SE of El Dorado, Sierra de Lema, 700 m, *Steyermark* 89412. NE portion of Cerro Sarisariñama, Meseta del Jaua, 1400 m, *Steyermark et al.* 109184. **Amazonas:** Cerro Sipapo, *Maguire & Politi* 27615-B, 27708, 27744.

14. *Cochlidium attenuatum* A. C. Smith in Gleason, *Bull. Torrey Bot. Club* 58: 308. 1931.

Grammitis tatei Copel. *Philipp. J. Sci.* 80: 120. 1952, *nom. nov.* TYPE: Based on *Cochlidium attenuatum* A. C. Smith in Gleason, *non G. attenuata* Kunze.

TYPE: Mt. Duida, Venezuela, 5500-6000 ft, *Tate* 428 (NY! isotype US!)

RANGE AND HABITAT: Fairly widespread through the Guyana Highlands of Venezuela and Guyana. Epiphytic or epipetric at 1500-2000 m elevation.

This species is somewhat marginally represented by the type of *C. attenuatum*. The smaller plants of the type collection show very narrow fronds with essentially entire sterile laminae, superficially resembling *C. wurdackii*. However, the specimens have large sporangia, long scales, large stomata, and the larger plants do have repand margins. So I feel that this type is for now sufficiently well placed with, if not especially typical of, this species concept.

I have applied this name to plants whose most conspicuous and distinctive feature is the lightly repand sterile portion of the frond. Such plants agree in other characters as well. The fronds are narrow, often 1 mm or less in width; in large plants up to 15 cm they may reach 2 mm across. The sori are usually confined to the distal quarter of the frond, which is here a bit expanded, and are somewhat irregularly disposed, but more or less confluent at maturity. The sporangial capsules are larger than in the last two species, 160-220 μm long, and the stomata and scales are larger than those of *C. wurdackii* (65-90 \times 55-65 μm and 2-3 mm long, respectively, in *C. attenuatum*).

REPRESENTATIVE SPECIMENS EXAMINED:

VENEZUELA: Bolívar: Cerro Guaiquinima, Río Paragua, open savanna 1 km S of Cumbre Camp, 1800 m, Maguire 32796. SW portion of Cerro Jaua, 2228-2250 m, Steyermark et al. 109604. Mt. Roraima, in Thurn 166. Upper cumbre of the NW cumbres of Churi-tepuí (Muru-tepuí), 2250-2300 m, Wurdack 34242. Headwaters of the Río Chicanán SW of El Dorado, Serra de Lema, 500 m, Steyermark 89598. Amazonas: Río Cunucunuma, Cerro Huachamacari, 1800 m, Maguire et al. 30305.

15. *Cochlidium connellii* (C. H. Wright) A. C. Smith, Bull. Torrey Bot. Club 57: 179. 1930.

Polypodium connellii Baker ex C. H. Wright in N.E. Brown, Trans. Linn. Soc. London, Bot. 6: 82. 1901. SYNTYPES: Summit, Mt. Roraima, British Guiana, McConnel & Quelch 570 (K not seen; isosyntypes NY! US!), 111 (K not seen), 118 (K not seen).

RANGE AND HABITAT: Guyana Highlands of Venezuela and Guyana. Epipetric, terrestrial, or occasionally epiphytic; at 1600-2300 m elevation.

This is manifestly and admittedly the least satisfactory species concept in this treatment of the genus. I have followed general usage and, I hope, the original description by applying the name to those plants with erect, coriaceous, congested fronds growing in tufts at higher elevations. These typically have fronds 3-6 cm long and 1.5-2 mm wide (Steyermark 59673, Vareschi & Foldats 4777, 4866, 4887). Except for the size, shape, and habit of the fronds, these are otherwise similar to *C. attenuatum* in their larger sporangial capsules 170-220 μm long, stomata 70-95 μm long, and distal, somewhat irregular sori. Also, the sterile laminae sometimes are very slightly repand. Contracted plants of *C. attenuatum*, such as Steyermark 109604, differ only in their narrower, more repand fronds. On the other hand, occasional plants with large sporangia seem very close to reduced examples of *C. furcatum* or *C. tepuiense*. As mentioned earlier, I believe that only field knowledge of these plants can clarify the problems here.

The typification of the name *C. connellii* and the present species concept must remain open to question. The protologue included three different numbers. I have seen duplicates of only one of these, and even the plants included there are not uniform. For instance, the sheet at US has three mounted plants. One has lightly

repand fronds ca. 1 mm wide and does not differ from the concept of *C. attenuatum* as accepted here. The other two have entire, coriaceous fronds ca. 1.5 mm wide and up to 7 cm long with large sporangia. The sori are irregularly distant with the lamina expanded around them, much as in *C. furcatum*. These plants do not fit well into any of the species here recognized. However, until all of the original material can be examined and until a greater understanding of the Guyana Highlands *Cochlidium* species is attained, I think it unwise to disrupt current usage of the *C. connellii*.

REPRESENTATIVE SPECIMENS EXAMINED:

VENEZUELA: Bolívar: Upper part of Auyan-tepuí, 2300 m, *Vareschi & Foldats 4887*. Plateau portion of SE-facing slopes of Ptari-tepuí, 1600 m, *Steyermark 59673*. Cumbre of the east-central portion of the Meseta de Jáua, ca. 60 Km. NW of the misión de Campamento Sanidad on the Río Kanarakuni, 1922-2100 m, *Steyermark 97988*. **Amazonas:** Cerro Sipapò (Paráque), 5500 ft, *Maguire & Politi 27615-A*. SE escarpment of Cerro Huachamacari, Río Cunucunuma, 1900 m, *Maguire et al. 30158*.

16. *Cochlidium wurdackii* L. E. Bishop, sp. nov.

Filicula gracillima tegetiformis quae ripas alpinas incolit. Rhizoma tenue repens frondes paulo dissitas gerens paleisque minutis triangularibus 0.4-0.7 mm longis ad basin 4-8 cellulas latis exigue vestitum. Stipes 2-10 mm longus basin versus teres 0.2-0.4 mm diametro. Lamina coriacea 3-7 cm × 0.5-1 mm, linearis fili similis, base acuminata apice rotundata aut obtusa, venatione et vagina costae sclerotica vix evidenti, costa e pagina ventraliter conspicue dorsaliter paululum exstans, sub juventute pilis pluribus catenatis ex 4-7 cellulis constantibus in costa utrimque praedita autem alibi et sub maturitate glabra, stomatibus abaxialibus 47-57 × 36-45 μm. Venae steriles plerumque simplices ad costam fere parallelae in hydathodos claras in regione mediali terminantes, illae fertiles ramo sorifero acroscopico distaliter recto neque non ramo brevioris basis copioso patentis. Sori distales, pauci 1-5 in quaque fronde fertili, inordinate dispositi, lamina in area sori latitudine expansa. Sporangiorum capsulae 160-190 × 130-170 μm, annuli cellulae 9-11, sporae 28-36 μm diametro.

HOLOTYPE: Abundant in mats on rocks along Río Sarvén, 1 km downstream from Camp 9, Sarvén-tepuí, Edo. Bolívar, Venezuela, 1200 m, *Wurdack 34349* (US).

PARATYPE: Terrestrial, frequent on river banks, along Río Tirica below Upper Falls above summit camp, central section of Chimantá Massif, Edo. Bolívar, Venezuela, 1940 m, *Steyermark & Wurdack 577* (US).

This apparently localized species differs from all others of the genus in its very small rhizome scales. Other characters which distinguish it from species with discrete sori include the slender, creeping rhizome, the very narrow fronds, and the smaller stomata. The habitat is also unusual in the genus. Both collections show the plants forming mats in sandy soil. All other species are epiphytic or grow among epipetric bryophytes.

The species is named for John J. Wurdack, not only for his responsibility for both gatherings, but also in recognition of the effect his considerable field effort has had in the advance of our knowledge of neotropical floras.

SPECIES IGNOTA NECNON DUBIA

Pleurogramme myrtillifolia Fée, *Mém. Foug.* 3: 38. 1852; 5: t. 10c. 1852.

Monogramma myrtillifolia (Fée) Hooker, *Sp. Fil.* 5: 125. 1864, as "*Monogramme*."

TYPE: Habitat in monte Tisis [Mexico?], collector unknown (possibly RB not seen).

This species is described as having small, spatulate, very thick leaves scattered on a long-repent rhizome. The locality is quite unknown to me, and it may not be American. Fée's illustrations of the whole plant very much suggest one of the smaller species of *Microgramma* or *Lemmaphyllum*, and the details could conceivably be juvenile or misinterpreted. Despite its inclusion in *Pleurogramme*, I very much doubt that this plant is a *Cochlidium*, but only by the rediscovery of Fée's type can the matter be settled.

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SHORTER NOTES

A DELETION FROM THE PTERIDOPHYTE FLORA OF NEBRASKA.—In the "Atlas of the Flora of the Great Plains" (Great Plains Flora Association, Iowa State University Press, Ames, 1977), *Lycopodium annotinum* was listed for the first time for Nebraska. The report was based on the following specimen: Kennedy, Cherry County, Nebraska, *Rev. John M. Bates s.n.* in 1892 (NEB 167907). Recently I had the opportunity to examine this specimen and found it to be correctly determined. However, debris at the base of the plant indicated that this specimen could not have been collected in Nebraska.

Abundant in the debris were leaves and cone scales, both staminate and pistillate, of *Picea glauca*, which does not occur in Nebraska. In addition, three mosses were discovered: *Polytrichum commune*, *Rhytidiadelphus triquetrus*, and *Thuidium minutulum*. The latter two species are not known in Nebraska. Considering the ranges of the spruce and mosses, the *Lycopodium* likely came from somewhere in the northeastern United States, where Bates is known to have collected on several occasions. In addition, the handwriting on the specimen's